

REMARKS

Claims 1-3, 5, 7-51 are pending in the application; claims 2-3, 10-47 are withdrawn.

Rejection under 35 U.S.C. 102

Claim 1 stands rejected under 35 U.S.C. 102(b) as being anticipated by *Inagaki et al.* (US 4,762,300).

Claim 1 as amended now defines a control device having at least one piezo element as a drive element arranged in the housing, wherein the at least one piezo element has a voltage-dependent stroke-force behavior. A piston and at least one pressure spring are arranged in the housing, wherein the at least one pressure spring has a first end resting against the at least one piezo element and a second end resting against the piston so that the at least one piezo element acts directly through the at least one pressure spring on the piston.

In the valve according to U.S. patent 4,762,300 the coil spring 282 (Fig. 2) acts only indirectly on the piston 18. The pressure spring 282 forces the valve ball 281 into its valve seat in the piston 18. When the piezo element 14 is excited, it must expand against the force of the spring 15. As described in col. 5, lines 42ff, the pressure medium that flows in via the inlet 32 forces the ball 281 against the spring force of spring 282 into its open position and the valve 28 opens. The pressure medium flows into the pressure chamber 16. When high voltage is supplied, the piezo element 14 expands so that the piston 13 that is directly connected to the piezo element 14 is moved against the force of the spring 15. In this way, the volume of the pressure chamber 16 is reduced. This causes the piston 18 in Fig. 2 to move to the right and the valve plug part 291 is lifted off the seat member 25. The pressure medium can flow out through the outlet 33 (arrow "OUT"). Therefore, the pressure spring 282 has only the task of pressing the valve ball 281 into the valve seat so that the pressure spring 282 cannot serve to directly move the piston when the piezo element 14 is excited.

The spring 15 also does not have the task of transmitting the length change of the piezo element 14 onto the piston 18. Instead, the piezo element 14 together with the piston 13 seated directly on the piezo element 14 serves only to pressurize the pressure medium contained in the pressure chamber 16 by reducing the volume of the pressure

chamber 16 and to move in this way the piston 18 in the described way. Accordingly, this configuration of the prior art cannot anticipate or make obvious the subject matter as claimed in amended claim 1.

Claim 1 as amended is therefore believed to be allowable.

Reconsideration and withdrawal of the rejection of the claims pursuant to 35 USC 102 are therefore respectfully requested.

Rejection under 35 U.S.C. 103

Claims 1, 5, 7-9, 48-51 stand rejected under 35 U.S.C. 103(a) as being unpatentable over *Coleman* (US 4,866,091) and *Weber* (US 5,911,245).

Claim 1 as amended now defines a control device having at least one piezo element as a drive element arranged in the housing, wherein the at least one piezo element has a voltage-dependent stroke-force behavior. A piston and at least one pressure spring are arranged in the housing, wherein the at least one pressure spring has a first end resting against the at least one piezo element and a second end resting against the piston so that the at least one piezo element acts directly through the at least one pressure spring on the piston.

Claim 5 as amended defines that a first pressure spring is arranged in the housing between the first piezo element and a first end of the piston and a second pressure spring is arranged between the second piezo element and a second end of the piston. The first pressure spring has a first end resting against the first piezo element and a second end resting against the first end of the piston; the second pressure spring has a first end resting against the second piezo element and a second end resting against the second end of the piston. The first and second piezo elements act directly through the first and second pressure springs on the piston that controls a flow of a pressure medium to a consumer.

The cited patent U.S. 4,886,091 to *Coleman* shows two pressure springs 100,116 on both sides of the piston 92 that are flexible drive members. In col. 1, line 65, to col. 2, line 5, it is disclosed in regard to these flexible drive members that the speed of movement of the actuator member and the speed of the movement of the valve component may be different. This is also disclosed in col. 2, lines 6-10, of *Coleman*. The springs 100, 116 are therefore damping elements. The efficiency of such known valves is reduced because

within the electrical part of the valve, energy must be expended for tensioning the springs 100,116. Decoupling of the elements as described is possible only because of the damping action of the springs.

Reference is being had also to col. 5, lines 51ff. According to this text portion, the speed of movement of the armature 114 compresses the flexible pressure spring 116 substantially but not completely when the armature 114 rests against the stop 115. Even though the spring 116 is tensioned, the piston 92 remains substantially at rest according to this disclosure. The pressure spring 116 thus stores the energy that has been exerted on the pressure spring by armature 114. In contrast to this, the pressure springs 10, 11 of the present invention have the task of directly moving the piston 2 in the desired direction and into defined positions when the appropriate piezo element 12 is excited.

The springs 100, 116 of *Coleman* cannot directly move the piston because the springs are compressed and act as damping means (col. 6, lines 3-7, of *Coleman* mentions also the damping function of the pressure springs 100, 116). Since the springs 100,116 of *Coleman* are damping springs, the damping springs 100, 116 are compressed without the piston 92 being moved when the armatures 98,114 are moved. The armatures therefore do not act directly through the springs on the piston for moving the piston in a desired direction or into defined positions.

The secondary reference *U.S. 5,911, 245 (Weber)* is cited to show that a PE device is equivalent to a solenoid actuator.

Coleman in combination with *Weber* cannot provide a suggestion for solving the problem of the present invention. The object of the present invention is providing short switching times while providing a simple configuration. Such short switching times cannot be achieved, not even in approximation, by the known valve according to U.S. *Coleman* because of the nature of the damping springs 100,116: using piezo elements instead of the solenoids of *Coleman* would not change the damping action of the springs 100, 116 and not direct action of the PE elements on the piston would result.

It is known to a person skilled in the art that piezo elements have only a minimal length extension. It is therefore desirable to employ a spring with progressive behavior. For this reason, a person skilled in the art would not combine damping springs 100, 116

according to *Coleman* with PE elements where very small length changes occur. It is therefore not obvious to combine PE elements with the damping springs of *Coleman* for transmitting a drive action because such a combination would be considered unsuitable by a person skilled in the art.

Weber shows a configuration where the pressure spring 39 only serves as a pretensioning element with which the piston 31 is forced into an end position. Therefore, this prior art reference does not show the possibility that a piezo element switches a piston by means of an interposed pressure spring.

In view of the above, neither claim 1 nor claim 5 are obvious in view of the prior art combination *Coleman* and *Weber*.

Reconsideration and withdrawal of the rejection of the claims pursuant to 35 USC 103 are therefore respectfully requested.

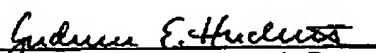
CONCLUSION

In view of the foregoing, it is submitted that this application is now in condition for allowance and such allowance is respectfully solicited.

Should the Examiner have any further objections or suggestions, the undersigned would appreciate a phone call or e-mail from the examiner to discuss appropriate amendments to place the application into condition for allowance.

Authorization is herewith given to charge any fees or any shortages in any fees required during prosecution of this application and not paid by other means to Patent and Trademark Office deposit account 50-1199.

Respectfully submitted on March 15, 2005,


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